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326

ON THE
CONSTRUCTION OF THE ARK
AND
STEAM NAVIGATION
TO INDIA.

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ON THE

CONSTRUCTION OF THE ARK,

AS ADAPTED TO THE

NAVAL ARCHITECTURE

OF THE PRESENT DAY;

ON THE

EQUIPMENT OF VESSELS,

AND ON

STEAM NAVIGATION

TO INDIA.

By W. RADFORD, R. N.

BIBLIOTHECA BODLEIANA

LONDON:
JOHN WEALE, 59, HIGH HOLBORN.
1840.

320.

ELLIOTT, PRINTER, HEREFORD.

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The Lords Commissioners,
executing the office of
High Admiral of Great Britain,
This Volume
Is most respectfully dedicated,
By their Lordships'
Very Obedient Servant,
THE AUTHOR.

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INTRODUCTION.

During the last year, we have heard of nothing but disputes and disquisitions upon naval affairs, and more particularly, on the inefficiency of our ships of war, which have given rise to many motions and much disscussion, as well in the House of Commons, as out of it; so that not a few have been induced to investigate attentively the subject of Naval Architecture, and it has been clearly ascertained that none of our naval builders had any fixed standard, rule, or guide to direct them but that every one designed, and laid down ships or vessels, in his own chimerical brain, and finished them with such improvements as suggested themselves in the progress of the work.

In illustration of this fact, let any one cast his eye over our crowded docks, both royal and commercial, and what a heterogeneous mass does he there behold,—no two alike, all differing in some particular or other, according to the whim and caprice of the several builders; this will, in some measure, account for the hitherto unexplained paradox, (as it always appeared to the Author) that however perfect one vessel might be, all the attempts to build another after the same model, have for ever failed in some material point,—the builder laying the fault on the equippers, and the equippers returning the compliment on the builders. Others, again, taking their models from such a ship or vessel, but adding length or breadth: others, again, in the same frame of mind, in order to deviate from their neighbours, reducing the length or breadth.

This absence of all scientific rules to work by inevitably perplexed and embarrassed the efforts of those, who in the laudable pursuit of professional excellence, sought after those different rules, plans, and directions, which have ever been adhered to, in the different orders of architectural buildings, and which have been handed down through the lapse of time,—the admiration of mankind, and the worthy objects of imitation, so that the smallest deviation from the established order, would be immediately detected and rejected accordingly. But of naval architecture, it may be truly said, that there is more science, more knowledge of the laws of nature, and their effects, requisite to perfect the art of building a vessel, than even in the erection of an Egyptian pyramid or temple.

How strange then for a period of four thousand years and upwards, that men should have gone on, each in his own way, when positive proofs and directions are plainly and forcibly laid down by the Almighty himself, in language and terms intelligible to the meanest capacity,—in language so plain and forcible that the greatest sceptic cannot attempt to dispute it, either by subtracting from it, or adding to it. For this is the plain and forcible passage of the Holy Writ, in the Sixth chapter of the book of GENESIS, and the fifteenth verse:—"*And this is the fashion, which thou shalt make it of, the length of the Ark shall be three hundred cubits, the breadth of it fifty cubits, and the height of it thirty cubits.*"

This passage of Holy Writ is very remarkable, and has always engaged the attention of scientific men, more particularly so, when in working out the tonnage of the Ark, as therein laid down, both by arithmetic and logarithms, the amount of burthen in tonnage is precisely the same. But this passage has lately received an additional stimulus, as well as a striking proof of its correct and true principle in ship-building, through the instrumentality of those two splendid vessels, "the Great Western," and "the British Queen," the proportional part of these ships being precisely the same as those laid down for the construction of the Ark. This happy event has caused a new light to shine forth on the all-important and engrossing topic of Naval Architecture; and it is not too much to infer that the dimensions of the Ark, as given by the Almighty himself to his servant Noah, were as much intended for man's mechanical guide and rule, as the cross has since been set forth, for his moral guidance and government.

The subject-matter of the present volume includes the illustration of the principles of the construction of the Ark, and the plan proposed for establishing a Company for the purpose of maintaining a regular and systematic communication with INDIA and ENGLAND, by Steam Vessels particularly adapted to this most desirable undertaking. But as the preparing of marine drawings and diagrams, and especially those of an improved system of rigging, would considerably retard the publication of the work, the Author has, at the urgent request of his friends, deferred this important branch of the subject for a future volume.

NOTE.

Ask SIR WILLIAM SYMONDS from what model he took the "Vanguard," and probably it may be from the "Bellerophon,—she from the "Thunderer," she from the "Sans Pareil." (taken by LORD HOWE on the first of June;) she from the "Non Pareil.?" So that it may be justly said, that they have no *Pareil* at all to direct and guide them; and so it has been in every age, country, and nation.

CHAPTER I.

ON THE CONSTRUCTION OF THE ARK.

The Ark has afforded several points of curious enquiry amongst the Critics and Naturalists, relative to its form, capacity, materials, &c. The wood of which it was built, was called, in the Hebrew, Gopher Wood, and by others, Cedar or Cypress Wood. The Greeks called it *Kuparissos* or Cypress; for taking away the termination, Kupher or Gopher differs very little in sound. This observation the celebrated Bochart has confirmed, and shewn very plainly, that no country abounds so much with this Wood, as that part of Assyria which is about Babylon.

In what place NOAH built and finished the Ark is no less a matter of disputation. Some suppose it to have been built in the Garden of Eden; but the most probable opinion is, that it was built in Chaldea, in the territories of Babylon, (as it was known to have been first floated by the breaking up of the waters of the Caspian Sea, and the Persian Gulph), where there was a great quantity of Cypress, in the groves and gardens, in Alexander's time; that he built a whole fleet of it, for want of other timber; and this conjecture is confirmed by the Chaldean tradition which makes Xisuthrus (a name for Noah) set sail from that country.

The time taken to build the Ark is also much disputed, some make it fifty-two years, others seventy-eight, one hundred, and one hundred and twenty. The latter period appears the most probable, as mentioned in the Sixth Chapter of the Book of GENESIS, and the latter part of the third verse. The Arabs say it was constructed in twenty-two years;—the Mahomedans allege, it only took two years to build it.

The dimensions of the Ark, as given by Moses, some have thought too scanty, considering the number of things it had to contain; and hence, an argument has been drawn against the authority of the relation. To solve this, Buteo and Kischer have proved geometrically, that taking the common cubit of Eighteen inches, or one and a half foot, the Ark was abundantly sufficient for all the animals supposed to be lodged in it. But the Scriptural Cubit was $21\frac{888}{1000}$ inches of our measure, or rather more than twenty-one and three-quarters, and was measured from the tip of the elbow, to the end of the middle finger; for the cubit of Noah, of Moses, and of Solomon, are all known and received, as written in Holy Writ.

Snellius computed the Ark to have been one and a half acre in area. It contained beside the members of Noah's family, one pair of every species of unclean animals, and seven pairs of every species of clean animals, with provisions for them all, during a whole year. The former appears at first view almost infinite, but if we come to a calculation, the number of species of different animals will be found much less than is generally imagined; out of which, in this case, are excepted such animals as are amphibious and can live in the water; and some affirm that only seventy-two of the quadruped kind needed a place in the Ark.

By the description Moses gives of the Ark, it appears to have been divided into three stories, each ten cubits, or fifteen feet high; and it is agreed upon, as most probable, that the lowest story was for the Beasts, the middle for the food, and the upper for Birds, with Noah and his household; each story being divided into different apartments, stalls, &c: although JOSEPHUS, PHILO, and other commentators, add a kind of fourth story under all the rest, being as it were the hold of the vessel, to contain the ballast, and a conservatory of fresh water, being, as we are informed in the Sixth Chapter of the Book of GENESIS, and fourteenth verse, "*pitched within and without with pitch.*" DRAXELIUS makes three hundred apartments; FOURNIER, three hundred and thirty-three; the Anonymous Author of the

Questions of Genesis, four hundred; others as many partitions as there were different sorts of animals.

As to the number of animals contained in the Ark, BUTEO computes that it could not be equal to five hundred horses; he even reduces the whole to the dimensions of fifty-six pairs of Oxen; so supposing one ox is equal to two horses (if the Ark had room for two hundred and fifty-six horses) there must have been space enough for all the different animals. But the same Author demonstrates that one floor or deck of the Ark would suffice for five hundred horses, allowing nine feet in length, and two feet in breadth for each horse.*

As to the food in the Second Deck or Story, it is observed by COLUMELLA, that thirty pounds of hay sufficed for an Ox a-day; and that a solid have taken shelter, and been saved in the Ark, had they only possessed faith, like Noah, to believe and be saved.

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* It is usual in Cavalry Ships, to allow twenty, to twenty-four inches in breadth, and nine feet in length, including passages &c; so that the Ark would have carried one thousand and eighty horses on each Deck, or three thousand, two hundred and forty horses in all, and plenty of room to spare for gangways, passages, water-troughs, &c.

The Jews have it in tradition, that after all the animals, with Noah and his household, were embarked, and the doors shut, that on the floating of the Ark, which was in forty days after the rains commenced, the ALMIGHTY stayed the flood for three days, to see whether any of his wicked people would believe, and be saved in the Ark, but they all flew to save themselves so long as they could discover either a Mountain or Rock to flee to; and this is called, amongst the Israelites, "*The Three Days' Grace.*"

The Internal capacity of the Ark was three hundred and fifty-six thousand, six hundred cubical cubits. According to GOERCHE, a Dutch author, the number of beasts received into the Ark was still less than other commentators have imagined; he reckons about one hundred and forty, to one hundred and fifty species of quadrupeds; of birds more in number, but smaller in size; of reptiles thirty or forty species. We know not more than six species of beasts larger than a horse, and many much smaller, even under the size of a sheep.

But what are we to understand by clean and unclean beasts, in the Mosaic account? Was the distinction, declared by Moses in the Law, known and observed before the deluge? Or did Moses mention it as known and practised before the Deluge? Or did Moses mention it as known and understood by the persons for whom he wrote? —It is probable that the distinction was known to Noah, and that the same animals were esteemed clean, while others were unclean, both by Moses and by Noah?—Now it is manifest that by pure or clean animals in general, those only were meant which might be offered in sacrifice, as bulls, sheep, goats, &c., with their several species; and the like amongst birds, as pigeons, doves, hens, sparrows, &c., for the common uses of life and food. Moses allows a great number of animals, but it is a question whether in this place, we are to extend the pure or clean animals beyond those allowed for sacrifice? The pair of unclean could only be one male and one female; but the seven clean beasts might be two males, and five females, one male for sacrifice, and the other for the propagation of the species. But then we do not require that absolute strictness on this subject, of which some others are susceptible, general ideas are sufficient.

Some have started difficulties with regard to the square and oblong figure of the Ark, but those persons do not consider that the vessel was not destined for sailing, or rowing particularly; but chiefly for floating on the waters a considerable time; besides, it may be proved by instances, that its form, and especially its proportional parts were not less convenient, when properly adapted for sailing or rowing, than it was commodious for carrying. It may be doubted whether the bottom was flat; it might be curved.

As many have expressed their surprise as to the square and oblong shape of the Ark, because it is not customary to see ships in this fashion;

nevertheless, the little rush-box, in which the infant Moses floated, and was rescued by Pharoah's daughter on the waters of the Nile, was after this construction.*

The vessel or barque where Danaé was confined with her child by Acrisius, was of this description. The barques, which the Romans called *Rates*, were of this figure. But we have no occasion to go down to the time of Pharoah, to prove the form and construction of the Ark, when it is borne in mind, that this description of vessel is very common in the present day.

The large barges that navigate up and down the Seine from Havre, Rouen, &c., to Paris, are many of them of this build. The same may be observed as to the barges that go up and down the Danube from Ulm to Vienna, Pest, Ofen, and down to Galatz in the Black Sea; and to bring the matter still clearer to the views of our readers, the coal-barges on the Thames, which may be seen in such shoals about London Bridge, are precisely of the form and build of the Ark, only they want a little more length. And lastly the billy-hoys, which come up the Thames from Rochester, Chatham, and sometimes from Wisbech, and even from Hull, loaded very deep with bricks, stones, hay, straw, and other lumber, work up and down under sails in awful weather, to the suprise and astonishment of all those who have witnessed them turning up, through the flats and channels at the mouth of the Thames, and which can be testified by thousands of living witnesses.

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* See 2nd Chap. of Exodus 1st. to 10th. verses.

HORNIUS, in his History of several empires, states that two ships were built after the model and proportions of the Ark. One, was one hundred and twenty feet long, twenty feet wide, and twelve feet deep. These vessels were at first greatly ridiculed and laughed at, but in the end were found to sail better, and especially carry more than the ordinary vessels. And after the nicest computation, and examination, with the greatest geometrical exactness, the most learned, and accurate calculations, and those most conversant in Ship-building, conclude, that if the ablest mathematicians had been consulted about the proportions of the several apartments in the Ark, they could not have done it with greater correctness; and this narration of the Sacred History is so far from furnishing Deists with arguments, wherewith to weaken the authority of the Holy Scriptures, that on the contrary, it supplies good arguments to confirm that authority, since it seems in a manner impossible, for a man, in the time of Noah, in particular when Navigation was not perfect, by his own wit or invention to discover such accuracy and regularity of proportion as are remarkable in the dimensions of the Ark; hence it follows that the correctness must be naturally attributed to a Divine inspiration, and supernatural direction.

The Subject is one of those which require acquaintance with almost all Nature, to enter minutely into all its details, in order to be able to do justice to it, and to demonstrate the practicability of the Mosaic account. But when we call to mind that the Patriarch was directed, and supported, by the Almighty himself; and that many proofs of an universal Deluge may yet be traced in every part of the Globe, there will appear abundant evidence for the satisfaction of every mind.

We do not propose at the present time to enter into such demonstration, but merely to offer a few hints for the reflection of the reader.

I. As to the Number of animals. How many really are distinct species, and not, since the Deluge, multiplied by climate, food, &c? The number is less than might have been supposed!

II. What degree of cold might prevail during the Deluge?—It was, no doubt, considerable, since the sun could not heat either the Earth or the atmosphere!

III. How many animals would become torpid, and consequently neither eat nor drink under that degree of cold? The cold of Winter has such an effect on animals in the present day.

IV. Was not the period of the Deluge wholly wintry?

V. How many animals eat little or nothing in darkness, even if not torpid?

VI. How many animals, &c., can go the year round, without multiplying?

VII. How many, under these circumstances, would want little or no attendance?

VIII. Is it not probable that only the carnivorous animals would want food, in any considerable quantities?

IX. But were they carnivorous before the Deluge?

X. If so, was that appetite suspended during the Deluge?

XI. Had they any fear of man before the Deluge?

XII. Were they torpid during the Deluge?

XIII. How many birds and reptiles would become torpid by the same circumstances?

XIV. How many insects, &c., and how long would their natural torpidity last after the waters were abated?

XV. It is possible that nearly half the creatures in the Ark would become torpid, and consequently they would consume neither food nor water while in that state?

XVI. Of oviparous creatures, the eggs might be preserved;—so of insects, grubs, &c.

XVII. In like manner, the seeds of plants, corn, &c; the kernels of fruit, and many plants in vases of earth, if they were not of a nature to be preserved by seeds?

XVIII. The seeds of many plants and trees float many thousand miles in the Sea, at this day, yet germinate on the Islands, on which they are driven by the currents, winds, and other circumstances!

XIX. The roes &c., of fishes float long in the Sea, yet revive at last.

XX. Many kinds of seeds, after being buried in the earth by a deep ploughing, if turned up by another deep ploughing, after ten or even twenty years, or more, will sprout and revive!

XXI. Many kinds of insects make their nests in the hollow of the earth, where their eggs are deposited many months before they come to life.

XXII. By management, many of the above circumstances may be advanced, or retarded, very considerably, as to the time of birth!

XXIII. During the Deluge, there was no genial influence of the Season;—no Spring,—no Summer!

XXIV. Therefore, it seems probable, that when the above, and many other circumstances, which greatly diminish labour, attendance, and consumption, are duly considered, the capacity of the Ark will be found fully adequate to all that it would be required to contain!

Notwithstanding that the whole of the Deluge, and the circumstances connected with it, were miraculous; yet, the above might be some of those steps in which the miracles might have been wrought,—that is to say, some of those natural principles employed to produce a supernatural effect.

According to generally received opinions, the Deluge was universal, but some sceptics have contended that it was only over a vast space of the earth, that the waters prevailed. There are some, who have even regarded the history of the Deluge, as made at will and pleasure, and contrary to positive facts, and equally so to common understanding.

But it may be assumed that the Deluge in the time of the Patriarch Noah was universal, because had it been otherwise, it would have been ridiculous and useless to have built such an enormous vessel as the Ark is proved to have been, and ordered by the Almighty Himself, to have contained the different animals of the neighbouring countries, where it was built. This, in addition to other proofs, will shew that there was nothing impossible, or indeed contrary to common sense or understanding in the history the Ark and the Deluge.

Taking the Scriptural or Mosaic cubit at $21\frac{888}{1000}$ inches of our measure, the Ark was of the burthen of $19,531\frac{81}{94}$ tons. It is not said whether the dimensions of the Ark were from outside to outside, or what was the thickness of its construction, but the above are taken as OUTSIDE dimensions, as naturally presenting themselves to the outside view. The above calculation is the old plan of measurement, taking NINETY-FOUR for the divisor. The new method of measurement lately introduced by Her Majesty's Customs, upon the authority of an Act of Parliament passed in the last Session, in worked by Logarithms, with the particulars of which method and rules, the Author is not yet fully acquainted.

DR. HALES, in his commentary on the Book of GENESIS, states the Ark to be forty-two thousand, four hundred, and thirteen tons burthen; but this is an error. For although he takes the Mosaic cubit correctly enough, and allows it to be, what in reality it is, as above, 21 $\frac{888}{1000}$ inches, he takes his divisor at FORTY-TWO instead of NINETY-FOUR, which is the given and accepted standard amongst all European Nations.

DR. ARBUTHNOT, in his notes on the Book of GENESIS, is still more wild in estimating the tonnage of the Ark at eighty-one thousand, and sixty-two tons; but then he takes the Mosaic cubit at three vulgar fractions from the standard of Og, King of Bashan. *

In the verse following the dimensions of the Ark, (the sixteenth of the same chapter) and in the first part of it, it is said,—"*a window shalt thou make to the Ark, and in a cubit shalt thou finish it above.*"

This evidently refers to the spring in the arch of the deck to shoot the water off, and if my readers will take the radius of a circle equal to fifty Mosaic cubits, they will find that to be the very best possible fall on each side, to shoot the wet off the decks.

It is evident there were no windows on either of the sides of the Ark, and that the window, spoken of in the verse, was to give light and air to the animals below.

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* See Deutoronomy 3rd chap: and 11th. verse.

CHAPTER II.

ON THE CONSTRUCTION OF THE ARK
(CONTINUED.)

THE vast capacity of the Ark will astonish a great number of our readers, as they can scarcely understand how a vessel could contain as much as nineteen ships of one thousand tons each, of the present day; nevertheless, the rules of geometry and arithmetic, worked from the Holy Text, shew it clearly; and we are not permitted to doubt it.

Ancient History boasts of many large vessels, which prove the possibility of the size of Noah's Ark.

DIODORUS, amongst others, says, that SESOSTRIS King of Egypt, built one of cedar, fashioned after the Ark, of two hundred and eighty cubits long.

PLUTARCH, in his life of DEMETRIUS, relates that PTOLOMEY PHILOPATER constructed a galley, of the same length, with forty ranges or heights of oars, navigated by four hundred sailors, and four thousand galley slaves, which could contain three thousand fighting men on its decks.

And MOSCHIUS describes the surprising galley which ARCHIMEDES constructed for HIERO, king of Syracuse, where three hundred master-carpenters, and a vast number of workmen used more wood in one year, in the building of her, than would have sufficed for the construction of sixty ordinary vessels.

But all these great vessels, and others, which we have not space to mention, did not approach to the structure or capacity of that stupendous vessel which had the Almighty for its architect, and the second progenitors of mankind for its crew, and has left evident proofs of the possibility and correctness of its construction: and we may, without a doubt, affirm, that she was the largest vessel, that ever was, or ever will be built, as no mortal man, of his own work, could ever have undertaken so vast a structure.

Through the Hebrews, have miraculously been preserved, the records of the dreadful catastrophe of the Deluge.

The Greeks have published them in their fables, to sustain and preserve their mysteries.

The Romans have disguised them from their true features, to appropriate them to, and enrich the records of their history.

The Arabs have ridiculed them by wild assertions, and extravagant explanations.

The Heathens have looked upon them as the manifestations of the displeasure of their Gods.

The Philosophers have treated them as full of improbable facts.

The Politicians have veiled them as the lure and charm of a superstitious people.

The Libertines believed them fabulous, and made them the subjects of ridicule and laughter.

The Sceptics finding them difficult and obscure, have treated them as mysterious.

Visionary interpreters, not being able fully to fathom them, have garnished them with the most absurd explanations, and by their ridiculous commentaries unworthy alike of their subject, and of all sensible minds, have endeavoured to make them more congenial to the ears of their hearers, by representing them as the offspring of fiction and romance.

The Jews and Mahommedans have always venerated them as proofs of wonders and miracles.

And lastly, the Christians have drawn from them motives of fear and remorse, arising out of the dreadful wrath and displeasure of an angry and offended God. But notwithstanding, a great many able men have neglected the attention which the subject demands, and have given up the pursuit without any attempt to solve its difficulties.

So many conflicting opinions will little influence the honest pursuer of truth, and the improvement of his country's interest! With whatever difficulties, the exertions he may find himself compelled to make, may beset him, he must not picture to himself an immunity from the disadvantages or discourtesies to which others, who like himself are rash enough to embark on the turbulent sea of letters, are exposed, but with all diffidence and humility, he encourages himself with the hopes, that if indeed he should fail in satisfying the expectations of his readers, he may, at least so far interest them in this curious and antient investigation, as to lead to its prosecution by some more able and accomplished hands.

But the author of these pages cannot help flattering himself nevertheless, that the discoveries he has made, are so singularly applicable to the present forth-coming revolution in all nautical affairs, that they will serve as a direction for the future improvements of all Naval Builders, to regulate their dimensions in the drafting, and their rulesin proportioning the various superstructures they may be called upon to erect, with something approaching at least to geometrical exactness, and not expose the most learned and accurate calculators to labour under the present imperfect definitions, as to the positive draft of water, as well as the great *desiderata* of velocity, capacity, size and length, which the present imperfect knowledge of Naval Architecture compels them to encounter.

In conclusion on this subject, for the present, the author has to express his grateful thanks to MR. ROSCHILD, who, although a stranger, and without any personal knowledge ofhim whatever, very kindly gave him a letter of introduction and commendation to the very learned the REV. DR. HERSCHELL, chief Rabbi of the Israelites, at the synagogue in London, to whose deep research, and masterly knowledge of the Hebrew tongue, he is indebted for a great part of the information he has obtained on this most difficult subject. The familiarity, with which the learned Rabbi, and his able coadjutors, handled every subject of Holy Writ, in the Old Testament, was extremely instructive and surprising. Whilst however, the author is rendering his just tribute of thanks to a Jewish Rabbi, let him not forget his obligations, which he thus gratefully records to a learned christian teacher, whose station and attainments are alike eminent in the church, and whose earnest desire, and active exertions for the public welfare, are constantly exhibited. To the kind and obliging disposition, and especially the good taste of the Dean of Hereford, he is indebted not only for clearing the decks of much that was rough and unsightly in the present volume, but for the launching, and setting afloat the work itself. As a scholar and divine, the very Rev. Gentleman appeared interested in the subject, which was first brought before his notice, as President of the Hereford Philosophical and Literary Institution, by a paper which contained, imperfectly, the substance of these pages; and the kind encouragement, then and afterwards, received from the learned President, induced the author to present his thoughts in a more enlarged, but still imperfect form, before the public.

CHAPTER III.

ON THE SIZE OF
VESSELS ADAPTED TO NAVIGATION,
AS DEDUCED FROM THE CORRECT PRINCIPLE OF THE CONSTRUCTION OF THE ARK.

The first great point in which we have not yet carried out our knowledge to the extensive practice of practical navigation is SIZE; and here we have to look forward to improvements of very great extent, in our general navigation, from increase of size alone.

The causes which give the advantages to a large vessel are manifold; and admitting that we double the dimensions of a ship, making her twice as long as before, that very additional length instead of having increased the resistance of the water in a corresponding degree to its velocity, has actually diminished proportionally that resistance, and to so high a degree, as to have counter-balanced altogether that part of resistance, arising from increased breadth; for the capacity, room, and accommodation of a ship increase in the ratio of the cube of her linear dimensions, while her sectional area, which gives her resistance, increases only as the square.

It will therefore be obvious, that the larger the ship, the less proportionate power to the tonnage is required to propel it, for it must be borne in mind, that the resistance a vessel experiences, in going through the water, is proportionate not merely to the square of the absolute velocity of the vessel through the water, but to the square of the relative velocity, with which it is thrown aside, and which is diminished in proportion as the length is increased; and furthermore, that the waves, or swell, caused by the back-water of the paddle-wheels are rather an advantage than otherwise, as may be frequently seen gathering up and following a ship, even when going against a "head-sea," and in a favourable gale, materially assist in propelling her.

The resistance, therefore, to a larger vessel, arises only from the increased quantity of fluid displaced by the increased section passing through the water; so that in enlarging the dimensions of a vessel, eight times the capacity or tonnage of another, it will only require for the same, or even rather greater velocity, four times the mechanical power, giving a saving of one-half, as regards the power, consumption o coal, and capacity of carrying goods.

With regard to the structure of steam vessels, experience will shew that both the entrance and run cannot be too fine; and that of the two, the run should be fuller than the entrance, being just the reverse of the old velocity system. Here, length is particularly applicable, as allowing so much length for the entrance and run, aud still preserving great space for the dead flats, which admits of so much capacity for carrying.

A vessel, thus constructed, will be easier, safer, and drier, than one after the old fashion.

The waves which strike a large vessel are not greater in size, than those which strike a small one, proportionally they are much less so; for any person may easily convince himself that the motion of the waves is not necessarily accompanied with a current of water in the same direction, by throwing any light substance into the sea, a little beyond the breakers, or into a piece of standing water, the surface of which is ruffled; he will see that such a floating body rises and falls with the motion of the waves, but does not perceptibly move towards the shore; this may also be assimilated to a high standing field of ripe corn, when the wind blows it to and fro, and yet it becomes erect, as soon as the wind has ceased.

Thus, the larger vessel is safer, surer, sails better to time, is drier, easier in the sea, and in every way preferable to the smaller one.

The successful voyages made by the GREAT WESTERN,—differing as that noble vessel does in so many important respects, especially size, tonnage, and consumption of fuel,—completely overturn the strange doctrine which, it may be recollected, DR. LARDNER, laid down, of the impossibility of a vessel steaming across the Atlantic, without taking in, at some intermediate station, a second supply of fuel, while it was proved by the GREAT WESTERN arriving only a few hours after the SIRIUS, which had five days the start of her from Cork, that had the course been a few hundred miles longer, she would most certainly have overtaken her.

Here is another proof what size will do, when systematically and proportionably worked together.

Under these considerations, after attaining the very best proportion and form of the parts, the important matter is size; the smaller the vessel with a proportionate propelling power, the smaller is the rate of speed even in smooth water, just as a long-legged animal gets on faster than a short-legged one.

But on rough water, the retarding friction increases with compound proportion, while the very distance itself is increased to the small vessel which has to pass up and down the opposite slope of the waves in an undulating course, whereas on the contrary, the large vessel goes directly through it.

If a vessel were constructed so large (as the Ark for example) that the largest waves of the ocean bore the same proportion to her, that the ripples of a calm do to a small vessel, then a speed may be obtained on the ocean, possibly equal to that, at present usual on our Railways; and the evil of sea-sickness, so fearful an infliction on passengers, would be almost entirely removed; for great length enables these Leviathans to compass three or four waves at a time, in a stiff gale, and even in a hurricane, at least the tail of one, and the head of another wave, which keeps them out of the trough of any undulating sea, so fearful at times to the short-beamed vessels of the present day.

In opposition to this new system in length of ships, many of the old school are continually asserting that they must break their backs, that they are certain of being hogged, &c., &c., with other alarming forebodings, taking up this doctrine one from the other, without giving any scientific reason or standard rule to elucidate their given and received notions and impressions. Now it would really be at least kind, and even patriotic, if these learned professors would inform us, "Why has not the GREAT WESTERN broken her back ?

Amongst many advantages in size, and consequently in speed of vessels of increased burthen, there are many fruitful sources of economy in expenditure, being far more important than economy in outlay. A larger number of passengers can be carried at a far cheaper rate than a small number, and steam can also be used with a less proportionate waste in large vessels, than it can in small ones; besides this, there is a saving of time, involving a great and expensive table and maintenance, with much wear and tear.

A passenger would much rather pay his thirty pounds down to traverse the same distance in ten, than in thirty days; and as the actual maximum speed for ocean Steamers is as yet far from being ascertained, owing to the expense attending experiments on a large scale, we cannot yet assign a limit:—one thing, however, has been satisfactorily shewn, that the largest vessels have always proved the swiftest, and this seems to indicate the principle which has yet to be worked out, for there are several Steamers in England which have reached a speed of fourteen and even fifteen miles an hour. The Great Western took but seventy-two minutes in going from London to Gravesend, a distance of twenty-two miles, being at the rate of eighteen and a half miles per hour; and deducting four and a half miles for TIDE, her rate was fourteen miles per hour. This can be proved, is well authenticated, and may be found in the log of the vessel.

At the account of the speed of some of the American boats, we shall cease to wonder, when we learn the enormous power by which they are propelled. According to MR. STEVENSON, some of them are provided with nine hundred horse-power, or more than twice the power of the Great-Western, in vessels scarcely one fourth of her size; but then, these are River-craft, and have no seas to contend against. At present, their rate of going is as strange to us, as the slow-moving packet-boats and barges drawn by horses. And we may reasonably hope, that ere long, as great a revolution will be made in marine travelling, as has been effected on Railways: for it is difficult and even totally impossible to assign a maximum rate, at which a vessel may be propelled by steam, when we consider the extraordinary and unaccountable speed at which whales are known to move through the waters.

Though Steam-navigation is universally admitted to be still in its infancy, the effects, it has produced already, and is rapidly producing, are of the most extraordinary and astonishing kind.

The Great Western passes and re-passes the Atlantic Ocean, a distance of three thousand miles, with the precision and safety of a mail coach: and all this vast power depends, in a great measure, on the building-yards, mines and workshops of England, which are thus in a wonderful manner made the means of diffusing Literature, Arts, Commerce, Civilization, and Christianity, throughout the whole world; for certainly no system ever became so popular, so suddenly, and so widely diffused.

One of the greatest benefits that can be bestowed on man is to supply him with the motives of exertion. All his powers of mind and body languish when they are not exercised. Of this truth, the history of Spain presents a remarkable instance. The vast accession of wealth which flowed into that country, after the conquest of Mexico and Peru, was attended by most unhappy consequences. Domestic industry and manufactures were checked by the want of a sufficient inducement to labour. The gentry learned to disdain occupation; pride and idleness then degraded the national character; and Spain was soon left behind other countries, in the progress of arts, commerce, and sciences.

Our mineral treasures, on the contrary, instead of giving wealth, afford us means of acquiring it; and the national spirit of activity and industry receives thereby a fresh impulse, and opens to us a new source of wealth and power.

Mechanism, the great power of Art, is as inexhaustible as any of the great powers of Nature; for it is the untiring vigour of the intellect, combining with, and commanding, the great secrets of Nature.

Ten thousand years might roll on, and each succeeding year see a new advance of every kingdom of Europe in inventions, and England keeping ahead of them all, and like one of her own engines, shewing her speed by the sparks that lighten the road behind her.

The steam-engine, in its really efficient and effective state, is little more than half a century old: in another fifty years, its present perfection may be looked upon as an ingenious play-thing. DARWIN, in his beautiful writings, little more than forty years ago, says,—

"Soon shall thy arm, gigantic Steam afar
Drag the slow barge, or drive the rapid car;
And on widewaving wings, expanded bear
The flying chariot through the fields of air."

The two first lines we have seen completely verified, and who shall say, what the next fifty years may achieve, in verifying the two latter.

It is scarcely ten years since the steam vessel ventured first on the open sea; thirty years ago, the late LORD STANHOPE was laughed at, for his attempt to swim the steam boat from London Bridge to Greenwich. It now dashes from thence and threads its way through the Archipelago to Constantinople; traverses the Black Sea; shoots down the Red Sea; fights the monsoon in its own ground; sweeps away to Bombay, Ceylon, and Bengal; and astonishes the Great Mogul, and Emperor of China, with the last month's newspapers from England.

What will all this come to in the next half-century?

What must be the effect of this herculean stride on the ways of this world?

What the mighty influence of that mutual communication, which, even in its feeblest state, has been in every age, the great instrument of civilization?

Throw down the barrier between two nations, and from that hour, both become more civilized. Open the close shut coasts of Japan and China to mankind, and from that moment, the condition of the people will be in progress of improvement.

The Barbarian and Despot hate the stranger. Yet for the most perfect civilization, freedom and enjoyment, of which earth is capable, the one thing needful, is the fullest intercourse of nation with nation, and man with man.

CHAPTER, IV.

ON BUILDING OF IRON VESSELS,

FROM THE CORRECT PRINCIPLE OF CONSTRUCTION OF THE ARK, PARTICULARLY ADAPTED TO SEA AS WELL AS RIVER NAVIGATION.

As iron has been the material in common use for some years back, in the construction of roofs for houses, and other domestic purposes, it seems now to be destined to another branch of national industry, far more important than the above, by being made the material in general use for the purpose of constructing vessels intended for navigation. This conviction is not only the result of work-shop details, but the general impression seems to shew that nature has provided stores of various kinds, for the use of man, suited for the several conditions of his constantly progressing inventions.

In man's earlier time, his fuel was wood, but as population thickened, wood lessened in quantity; and nature's next provision was laid bare to his view. Coal was the fuel suited to his improved condition. When his knowledge was sufficient to devise means of raising it from its subterraneous store-houses, he first consumed the upper stratum, and his knowledge became enlarged, to penetrate to still deeper stores. Through the instrumentality of coal, have the modern wonders of locomotion been achieved; but as coal is constantly decreasing in quantity, not being reproduced by nature, some have calculated that at a distant period, it will cease to exist. That period however, must be very distant, if we are to believe (as it is asserted) that there are twelve beds of coal in the South Wales coal-field, from three to nine feet thick, making seventy and a half feet; and eleven others, from eighteen inches to three feet, making twenty-four-and-a-half-feet; the whole therefore being ninety-five feet of working coal. The area is one hundred square miles, which will produce one hundred thousand tons of coal per acre, or sixty-four millions of tons per square mile, which, at ten million tons per annum, the present rate of consumption, will suffice for six thousand, four hundred years. But ere that period shall have arrived, the constantly progressing knowledge of man will have discovered means of extracting heat by chemical agencies, as superior to coal, as coal is to wood.

In like manner, nature seems to have provided trees for us, for the purpose of ship-building, fitted for the slow progress hitherto attained, but of too slow growth for an increased activity of locomotion. The increase of population, in England, cannot afford forest-space, and the ample stores of iron, useless in former times for want of knowledge necessary to make them available, are now more valuable than the organic material of the forest.

Several Iron vessels, both for River and Sea purposes, at the same time steamers and sailers have already been built, and as it befalls most novel plans, prognostics are rife that it is impossible to bring iron vessels into general use, especially for sea. The reasons, alleged against them, are as follows:

I. The liability of iron to rust, and the consequent quick destruction of the vessel.

II. The danger of breaking large holes in them when striking against obstacles.

III. The liability of leakage from the vibration of the engines.

IV. The impracticability of navigating them across the ocean, owing to their effects on the compass.

The answers to these objections are :—

I. Rust may easily be prevented by the simple and unexpensive process of painting.

II. The second is wholly an unsound objection, for, an iron vessel striking against any obstacle, would merely become dinged and rebound, whilst the wooden vessel would be cut through, and the planks started with an equivalent shock. In elucidation of the above fact, the

"GARY OWEN" an iron vessel built at Liverpool for the Irish Steam-boat Company, was towed over to Ireland by one of their steamers when the tow-rope broke, and she was drifted on the rocks off LOCH DERG; in this perilous situation, she was given up for lost, but when the tide receded, and left her high and dry upon the rocks, she was found not even with a hole in her bottom, but some of her plates were merely dinged in. Where under similar circumstances must a wooden vessel have been ?

III. This objection is of more importance, from the liability to leak, from the vibration of the engines; it may be also applied to wooden vessels, for although wood may swell and diminish the effect of the leak, which is not the case with iron, yet all those, who are accustomed to steam vessels, know well how fearfully the boilers frequently leak, and the bearings of the working beams lift and fall, as well as the combings of the hatches work loose against the butt-ends of the deck-planks; but the fact is, there ought to be no mischievous vibration for an engine taking place in the hull of any steam vessel; it is an evidence of a bad, defective, and imperfect construction; so much wasted power, for destructive purposes, and tending to impair speed.

IV. This objection does not appear to be well-founded. All steam vessels have a large proportion of iron used in them, yet still the compass works; the method of obviating this difficulty, if difficulty it be, is very simple, and easily attainable, by making the attraction equal on both sides. Theory as well as practice would seem to indicate, that if iron be disposed in equal quantities, at equal distances, the effects would be NIL.

The Government in order fully to establish this fact, directed Professors Farraday and Airey, to make an experimental trial on board the Rainbow, an iron ship, on the magnetic attraction, from London to Antwerp and back, the evidence adduced thereby was very satisfactory; and since that period, the Ironsides (an iron sailing vessel) made her voyage from Liverpool to Perambucco, and home again, having completely established the above facts, as to the effects on the compass.

Now there are many positive advantages to be found in iron vessels.

I. Their Incombustibility. This quality, in an ocean Steam-Ship, is a *Sine-qua-non*, for how a wooden vessel roasted to dryness by a continuous heat is to be extinguished, when once fairly set on fire, the Author is totally at a loss to discover, except indeed by the ingenious method of SIR ABEL HANDY's plan in "SPEED THE PLOUGH"—"Perhaps it will go out of itself!"

II. Their great saving in expence of building, and great economy in keeping in repair, not being one half the weight of a timber vessel. Hence, the difference can be supplied in cargo, engines, fuel, &c; and consequently, a vast saving of space, and increase of power are effected.

III. Their great buoyancy in the water, enabling them to carry a much greater weight of cargo, with the same displacement of water, as by a wooden vessel.

IV. Iron Ships are not so liable to be wrecked. They may, if built with iron compartments or bulk-heads, which strengthen the vessel most materially, be truly called Safety-Ships; so that the crew, and consequently the passengers can never, under any circumstances, be either burnt or drowned.

V. Iron vessels are not liable to injury from hot climates, or lightning, or fire; the whole collapses and expands together, whether in a hot or cold climate. In the former, the whole is kept cool. They are not liable to leakage, so that no damage can arise from bilge-water to the cargo, or to the crew from unhealthy odour.

VI. The iron ship is one solid block or mass not admitting of the slightest twist or hog, or change in its position, and true in its component parts, the one to the other. The machinery can be fixed firmly without the slightest chance of its various parts working loose, or becoming twisted; in short, it can work with every advantage as if on TERRA FIRMA. The small iron steam vessels, that ply on the Thames between the bridges, although built merely of sheet iron, yet are found to sail better, and especially to be stiffer, and consequently to experience less vibration from the engines than wooden vessels built proportionally light for small draft of water.

VII. Iron vessels would sustain no injury in working their full power in any gale of wind, and would be too buoyant to work under the waves; whereas in working wood steam vessels against the same impediment, the machinery can only be exerted with great caution, without risking the destruction of the vessel. Such is the alternate action of the ship and machinery against each other, that if the power of the engines was not at times to be reduced in a gale of wind, instead of its being then worked to its utmost, WHEN MOST REQUIRED, the leakage would sink her, and in many cases, no ordinary-built-wood ship would hold together.

VIII. Iron ships are especially calculated for that vast revolution of the world which is at hand by steam-ships superseding every other mode of navigation or sailing.

IX. Without iron ships, this could never be; from the difficulty of building very large ships of wood to draw little water, with a due regard to those principles of naval architecture which are indispensable in their construction.

X. To iron ships it is scarcely possible to affix a limit;—the only limits indeed may be said to be those which are commensurate with the extent of traffic; but as far as relates to the strength, buoyancy, velocity, capacity, and control, there is no limit. Whereas, wooden ships of an ordinary build have been made as large as can be deemed advisable under sails. Here has been the limit to these, but where will be the limit of steam-power now acknowledged by all to be still in its infancy?

XI. Iron ships have so many advantages over wooden ones, that they only require to be known and understood, to be universally adopted to the exclusion of all others. No wood ships can compete with iron ones in profit, time, safety or accommodation; and wherever wooden ships are now employed, iron ones will supersede them, and defy competition, even with the old-established trades; and it is the opinion of many, that in less than half a century more, no large wood ships will be built in England, either for royal or commercial purposes.

XII. The facility with which iron can be formed into any shape, or made of any size, as well as every scrap of iron wrought up to any required form, and made available to any purposes, whilst all the plates, knees, bolts, and straps, have that form given them, by which they are kept in their places, is a singular peculiarity. For every one knows the manifold purposes of this useful metal. It is capable of being cast into moulds of any size or form, of being drawn out into wires of any desired strength or fineness; of being extended into plates or sheets, of being bent in any direction, of being sharpened, hardened, and softened, at will and pleasure. Iron accommodates itself to all our wants, desires, and even our caprices;—to Agriculture, to Navigation, and to War. The same ore furnishes the sword, the plough-share, the scythe, and the pruning-hook.

By the above, it might be imagined by some of our readers, that nothing but iron ships are to be brought into general use. But this must be qualified,—it must be understood, that the decks, knees, and beams of iron ships are all of wood; the latter in particular, are made from the fine lengthy, straight oaks now so luxuriantly growing in so many woods and plantations in different parts of the kingdom, which as they grow up, must always be in great request for that purpose.

CHAPTER V.

ON THE SIZE OF VESSELS SUITED FOR THE NAVIGATION TO INDIA,

ACCORDING TO THE TRUE AND CORRECT PRINCIPLE OF THE CONSTRUCTION OF THE ARK.

This brings us next to the all-engrossing topic of interest,—the subject of steam navigation to India, by the way of the Cape of Good Hope. For notwithstanding the public discussions to which India has given rise for years past, she is really but little known to the people of Great Britain.

Such an influx of visitors to that country, as a well conducted steam conveyance could insure, must produce the most beneficial results, by tending greatly to dissipate that ignorance of each others' habits and feelings, by drawing the inhabitants of both countries into a close connection and more frequent intercourse, and by giving a practical reality to the happy bond of union which ought to exist between them.

It would be endless to point out the various other advantages which would accrue from this increase of intercourse, and rapidity of communication between England and India. Amongst those, the great benefit in saving of time in the transmitting of letters, and in the conveyance of goods and passengers, will readily suggest itself to every man in business. Another prominent advantage would be the effect on the military services of both countries, and its influence on the public peace, from the facility and rapidity with which large bodies of troops, with their artillery, cavalry, and stores, arriving fresh and vigorous at the scene of action, instead of being worn out with long and forced marches, could be conveyed at any notice across the country, either to repel foreign aggressions, or to suppress domestic contentions. Indeed we cannot describe limits wide enough for the future influence of this principle in creating new resources for the population, or in giving directions, as yet unknown, to those already possessed.

What has already been accomplished, and as it were in the dark, seems but an earnest of advantages yet to come, when experience and capital shall have shed their full light upon this subject and brought this stupendous power more within the grasp and controul of man.

As an immense capital, however, must be staked on the grand problem of steaming the high seas. It is therefore of paramount importance, that the greatest attention must be paid to the size, structure, and materials of the new steam ships.

For the effectual performance of a regular steam communication between England and India, *via* Cape of Good Hope, it is essential, nay it is absolutely necessary, that the ships should be of great size, power, and strength, combining velocity with great capacity and safety.

The ships, destined for this all-important service, should be three hundred feet long, fifty feet broad, and thirty feet high, and three thousand, one hundred and ninety tons register burthen, and should be built of ¾ and ⅝ inch plate-iron, rivetted and secured on angle and double angle, fish-back iron double flanged, of proportionate strength for the framing of the vessel, to be worked by three engines of two hundred horse power each, all working on the same shaft.

An iron-built vessel, of the above tonnage and construction, will weigh six hundred and sixty-five tons. Six iron compartments or partitions to render them Safety ships, from either fire or water, seventy eight tons. Beams, decks, &c., (the latter of wood) one hundred and sixty-five tons, making the total weight, nine hundred and eight tons.

A wood-built ship of the above size, constructed of Oak, with all the necessary fastenings, kneeings, beamings, and deckings, complete for launching, (without iron compartments) will weigh, two thousand, three hundred and ninety-two tons; the difference in weight, being, in favor of the iron ship, one thousand, four hundred and eighty-four tons. Hence it follows that the latter number of tons of cargo might be put into the iron ship, to make her draw the same water as the wooden ship without anything on board.

The above iron ship built expressly for great velocity, and consequently very sharp forward, and very clean run aft, would be comparatively light and buoyant with her cargo of four thousand tons on board, whereas the wood-built ship, after the same form with regard to velocity, would be so immersed in the water, that it might be a question whether she would be in a proper state to encounter very heavy weather.

Another great advantage attending the building of so large a vessel in iron would be, that her rise of floor from the dead flats might be brought up even at right angles, if deemed necessary so to do. But this could not be the case in wood, for it would be extremely difficult and expensive to obtain crooked timber of sufficient length and strength, to rise so suddenly from the floor, with a due regard to the grain of the timber so indispensable in their construction.

With reference to the difference of expense in building, it is most strikingly illustrated in favor of iron. An iron vessel of the above burthen, viz: three thousand, one hundred and ninety tons, would be built at twelve pounds and ten shillings per ton, making the total cost thirty-nine thousand, eight hundred and seventy-five pounds. A wooden built vessel of the same burthen, built in the river Thames, at twenty pounds per ton, would cost sixty-three thousand, eight hundred pounds; the difference in favor of the iron ship being twenty-three thousand nine-hundred, and twenty-five pounds.

With regard to keeping in repair, here again, the iron vessel presents a marked difference of expense in its favor. It is a fact on record, which may be found on the log of the IRONSIDES (the first iron sailing ship) that she made two voyages from Liverpool to Perambucco and back, without even pumping her out at all! and the presumption is that an iron vessel would continue for very many years on constant service without having occasion even to try the pumps, and consequently no damage could arise to the cargo, from leakage. Whereas the wooden vessel, in every gale of wind, is more or less strained, and requires a constant attendance on the pumps to prove the state of the well.

A vessel, of the magnificent description we have mentioned, would make the passage from London to Calcutta in all seasons, and under all circumstances, in forty working days, the distance being scarcely less than twelve thousand miles. For certainly it is not assuming too much in estimating the daily progress of such a vessel, as here laid down, to be three hundred miles a-day, calling at the Cape of Good Hope, Mauritius Point de Galle, Madras, and thence to Bengal, to take up, and set down passengers and light goods, three hours at each place being quite sufficient time allowable under a systematic and well organised plan of embarking and disembarking.

As the above vessel would carry four thousand tons, if two thousand, six-hundred tons are allowed for engines and fuel, for the whole passage, the necessity of stopping to take in a fresh supply of fuel would be superseded, and would then leave one thousand, four hundred tons, for the stowage of merchandise, baggage, troops, stores, &c.

Her accommodations for passengers would be on the most splendid scale. Three large saloons, or dining-rooms; upwards of three hundred bed-places, divided into one hundred and fifty cabins, would be conveniently arranged. Some would be single, others double, and some would have four sleeping-berths in each cabin; with accommodations for steward's pantry, store rooms, two smoking rooms, twenty hot and shower-baths, twenty water closets, all so classified and appointed, that no hotel in Europe could better afford comforts and luxuries for gentlemen, ladies and children; and in order the better to adapt and reconcile all orders and degrees of passengers, their society, repasts, and apartments might be divided into different classes.

In order then to keep up a regular, systematic, and well organised establishment between England and India, it would probably be necessary to have five of these magnificent vessels to maintain a certain monthly communication, and as there will be occasion to speak of these vessels hereafter, it will therefore be requisite to give them names by way of distinction; and as every thing, in the present day, is called after Her Majesty Victoria, they may not inaptly be christened:—

First,—The Queen of the Ocean,
Second,—The Queen of the Seas,
Third,—The Queen of the Isles,
Fourth,—The Queen of the East,
Fifth,—The Queen of the West.

As each of these stupendous vessels would cost, when completely equipped for sea, including engines and all necessary MATERIAL, one hundred thousand pounds each, it would require a capital of half a million sterling to set such an establishment on a permanent basis.

It would be an endless calculation to give an estimate of the immense revenue derivable monthly from such a national undertaking on the above enlarged scale; and when economically and systematically worked together, would put any combination or opposition quite *Hors du combat.*

Those engaged in commercial pursuits will be able to make more frequent voyages to superintend their affairs in person. They will do so in less than a third of the time now taken up, which also applies in the same RATIO, as to expense of outfit, fatigue, and health. They will be enabled to transmit, or to comply with foreign orders, with an equal dispatch, and economy of time, certainty, and safety, and with half the rate of insurance demanded in the present slow, and uncertain mode of conveyance by sailing vessels.

Those not engaged in business will find an advantage in being approximated to their distant friends, and placed in the position of receiving or transmitting information in less than half the time, now consumed in the interchange of intelligence; and it may be taken for granted as a principle that all will adopt, who can either save time or money.

The enterprise and skill of this country will not lie dormant; the prejudices of the few will, ere long, give way to the wishes of the many; and those obstacles, which are too often thrown in the way of national undertakings, like the present one offers, will hourly diminish, as the vast importance of such enterprises come to be understood.

As, however, it would be necessary to apply to Parliament for an act for such an undertaking, let it be hoped that the Legislature will be guided by the desire to afford to the public the best and most useful establishment, without reference to the prejudices of the few, who may be opposed to it, should any such exist. This company ought not to be considered in the light of a private speculation, but be supported by all parties, when it comes before the Legislature as a great national undertaking, beneficial in the highest degree both to this country and to India.

The power of that great ally of human inventions,—Steam, by which already difficulties have been surmounted beyond the power of human strength to contend against, will be applicable even to the conquering of space and distance; and the condition of man's existence will thus be raised, as it is by every contrivance, whereby his sphere of action is increased, or his comforts and conveniences are extended.

Let the friends, therefore, of this undertaking, not flag in their endeavours to attain the noble objects which it holds out; and let its enemies pause, and enquire further into its merits, before they offer to it a blind and undeserved opposition, thereby destroying the favourable interest of those who might otherwise feel disposed to give it their support.

The former persons may be ready enough, for their own purposes, to stir up, and excite opposition against a rival, whose success they dread; but let not the Legislature become a tool in their hands, for the mere purpose of supporting unjust monopolies, but rather let them consider the fact that any national measure, beneficial to the public weal, must to a very great extent, prove beneficial also to individuals.

Let them carefully weigh the advantages that have arisen from the exertions and enterprise of other Steam-boat companies, and those which this undertaking holds ont, as compared with the existing interests, which opposers seek to protect: and we do not doubt, if such an enquiry be entered into dispassionately, the result will be a determination, on their parts, not to oppose a measure loudly called for by the country, and tending to its manifest improvement.

It is not impossible that some might be disposed to look, with suspicion of interested motives, in a project advocated by a trader for mere mercantile advantages, just as limited confidence would be placed (exclusively for naval purposes,) on a naval speculator. But when a measure combining the highest naval and commercial improvements, emanating from a body of influential men in both departments, is propounded, we are led at once to suppose that they feel that measure to be advantageous not only to their reciprocal interests, but to those of the country in general, and one which deserves therefore the support of all who are desirous of advancing their country's honor. If however there should be any who persist in maintaining their rashly-formed opinions against this measure, let them look to the whole history of commerce,—let them examine how entirely its success has been mixed up, and marched progressively, with the improvements in conveyance.

Commerce is the interchange of commodities, and the greater means afforded it for its increase, and for the inter-communications of persons engaged in such pursuits, the greater must be the prosperity of trade itself. A striking instance is afforded, even at the present time, of the benefits arising from a facility of intercourse, as compared with the contrary effects of preclusions from such a desirable object.

It is known that the low countries, under a disadvantage of climate, at this moment, support a larger population on a given space than any other country in the world. The people are industrious, thriving, and happy. If we look to the cause, we find the whole kingdom intersected by canals, constantly in use, affording employment to thousands, giving space to commerce, and thus extending, in all directions, the wide ramifications of benefit arising from active and useful occupation.

Let us turn from this picture, and cast our eyes on Spain. We find a fine climate, a people naturally inclined to be intelligent, yet a scanty population plunged in sloth, poverty, ignorance, and superstition. Let us enquire for the cause, and we discover it in the inability afforded by the country for the interchange of commodities. One province produces wool, another grain, another wine, another oil, another minerals;—had they but the means of interchange, constant employment to thousands would be the consequence. The energies of the people would be awakened, and they would soon be raised from a state of poverty and moral degradation, to one of comparative affluence and independence.

True it is, that the United Kingdom of Great

Britain does not admit of any comparison with the picture represented, because we have good roads, excellent canals, and railways; but surely none who have received the benefits that have accrued to the country, from the improvements in each of these modes of conveyance, will assert that we should restrict ourselves from grasping the proferred benefits which Steam-Navigation holds out, as those which are incomparably better; for all must agree as to the wonderful advantages that have already resulted, and must continue to increase from the adoption of steam power, for the purposes of traversing our coasts and islands. And shall we, who have felt, and are capable of appreciating those advantages, deny ourselves the benefit that would inevitably arise from the application of the same power, for the purpose of trafficing with our gigantic colonies?

Independently of the vast importance of so national an undertaking, to which we have attempted to draw the attention of our readers in the preceding pages, the benefits that must accrue to individuals will be manifold, Amongst them may be enumerated the convenience and comfort to be derived by passengers in taking voyages at least one half of the present unavoidably expensive rates, and in their enlarged and consequently improved circle of fellow-travellers. Added to which, must be mentioned the superiority of accommodation afforded by such an establishment, from the tenfold increase of the number of passengers, and the decreased length of time occupied in passages from this country to India.

The commanders of such splendid vessels, as those already described, will be able to maintain a table equal to any hotel in the British Metropolis, with a plentiful supply of Burgundy, Champagne, and Claret, *a volonte*, considerations of no little weight with our sea-faring brethren.

The continued intercourse this establishment would keep up, would not only be extended to the transport of all the present number of troops and passengers, but would afford to our fair friends, a very pleasant and agreeable opportunity to many of the mamas and aunts, to take an oriental trip to see their sons and nephews, accompanied by their accomplished daughters and nieces, for the benefit of their health; and be further the means of multiplying the fruitful scions of Albion's chaste daughters, by introducing them to the admiring and gallant sons of England's pride and strength on the fertile plains of Hindostan.

CHAPTER VI.

ON SLOW STEAMERS.

Another class of vessels, of the same size as those described in the preceding chapter, may be built, and equipped with two engines of fifty horse-power each, denominated Slow Steamers, for the purpose of carrying heavy cargoes, and therefore might be made a little fuller, and be rigged with five masts; namely,—the Fore, Middle, Main, Mizen, and After-Mast, with sliding Gunter Top Masts and Yards, to lower down, and be reefed as occasion may require; and by slacking two shrouds of the Lee lower rigging, the canvass might be reefed by lowering the yards half-way, or more, if necessary, to the deck; and thus, the sails, in the most violent hurricane, would be kept low down to the deck, and consequently they would not produce that tremendous strain on the vessel, as in the ships of the present rig, loaded with so much top leverage, which causes the vessel to strain heavily, without propelling her more, if so much, as the above snug and compact method.

It may be said that no private individual would be able to build, and equip such a vessel, nor could any mercantile house, however great their consideration and interest, be able to load a vessel of such a size and magnitude. The answer to this objection is very simple.—Let ten individuals, or mercantile houses be concerned in one of these vessels, instead of the same number of individuals having ten ships of three hundred tons each; and they would soon find, with proper management, a much better dividend from one such magnificent vessel, than from ten smaller ones. The saving of time alone would enable them to carry goods at a much lower rate, than can now be effected, owing to ships having so long to wait for their cargoes; whereas a steamer, although a slow one, would always have the preference over sailing vessels, at the same rates of freight. And as she could under any circumstances always command two voyages for one, the difference in extra expense of working only two fifty-horse engines, to effect a speedy passage, would be soon reimbursed.

How admirably adapted would the above class of Slow Steamers be for carrying horses from the River de la Plata, where fine blood horses, sixteen hands high, from the Pampas, are to be obtained of any age or colour, for the remount of all the cavalry in India, instead of the miserable little cat-legged Arabs, bought at an enormous price for the remount of the Regiments in India, and totally unfit for European cavalry. Such a vessel as the above, properly fitted up for horses, would make up between eight hundred and nine hundred stalls, with plenty of space and stowage for hay, corn, water,—for double the length of passage required.

CHAPTER VII.

ON THE ADVANTAGES OF STEAM NAVIGATION.

Let those who regard speculations like these (which we have endeavoured to promote, by our observations, in the preceding pages,) as wild and impracticable, recur to the state of public opinion, at no very remote period, on the subject of steam navigation.

Within the memory of persons, who have not yet passed the meridian of life, the possibility of traversing, by means of the steam-engine, the channels and seas, that surround and intersect these islands, was regarded as the dream of enthusiasts. Nautical men, as well as votaries of science, rejected such speculations with equal incredulity, and with little less than mournful distrust of the understandings of those who could for a moment entertain them.

Yet we have witnessed steam-engines traversing not only these seas and channels alone, but sweeping the face of the waters around every coast in Europe, and even ploughing the great oceans of the world; and if steam be not used as the only certain means of connecting the most distant habitable points of the globe, it is not because it is inadequate for the accomplishment of that end, but because local and incidental causes limit the supply of that material, from which, at present, it derives its power.

Capital and skill have, of late years, been directed with extraordinary energy to the improvement of steam navigation, as well as that of inland transport by canals, rivers, and rail-roads, and this important source of national wealth has received a proportionate impulse.

Efforts have been made, and their effects witnessed, which, had they been narrated a few years since, could only have been admitted into the pages of fiction, or volumes of romance. For who could have credited the possibility of ponderous vessels, worked by steam, and laden like Noah's Ark with several hundreds of living animals, taking flight from Ireland to Liverpool, with almost as much certainty as to time, as the best regulated mail coaches perform an equal distance, yet this is a matter of daily, even hourly occurrence.

The important commercial and political effects attending such increased facility and speed in the transport of persons and goods, are too obvious to require any very extended notice here. A part of the price, and in some cases, a very considerable portion of the cost of an article of necessity, or of luxury, consists in the expence of transporting it from the producer to the consumer; and consequently, every abatement of expense in cost, must effect a corresponding reduction in the price of articles which are necessary for the subsistence of the poor, or for the enjoyment of the rich,—indeed of every comfort, and every luxury of life.

The benefit of this will not extend to the consumer only, but to the producer also, by lowering the expense of transport of the produce, whether it be of the soil, or the loom. A smaller quantity of that produce will be spent in bringing the remainder to market, and therefore, a greater surplus will reward the labour of the producer, and the trouble of the trader who carries such commodity to market.

The reduction in the cost of transport of manufactured articles, by lowering the price in the market, will stimulate their consumption. This applies not only to home, but to foreign marts. In the latter we already, in many branches of manufactures, command a monopoly; the reduced price of which, we shall obtain by cheapness and facility of transport, will still farther extend and increase our advantages. Those of increased cheapnesss and speed, besides extending the amount of existing traffic, will create fresh objects of commercial intercourse, as well as new markets of manufactured and agricultural produce.

The great speed of transit, which has been proved to be practicable, must open a commerce between distant parts, in various articles, now scarcely known, the nature of which does not permit them to be preserved, so as to render them fit for use beyond a certain time; such as many species of fruit, animal and vegetable food, which, at present, are confined to markets at a limited distance from their native soil.

But the peculiar nature of steam boats, the magnitude, and the weight of freights which may be transported, and the prodigious speed which may be attained by them, render the conveyance of living animals, to almost any distance, both easy, cheap, and certain.

The moral and political consequences of so great a change in power of transition of persons and intelligence from place to place, now so remote from each other, are not easily calculated.

The concentration of mind and exertion, which a great nation ever exhibits, will be extended in a considerable degree to the whole universe.

The same effects will be produced, as if all distances were lessened in the proportion, in which speed and cheapness of transit are increased.

CHAPTER VIII.

ON THE EQUIPMENT OF VESSELS.

Amongst the many reformations which the advanced state of Naval Architecture is destined to undergo, in the forthcoming revolution in the different departments of Naval Science, in consequence of the almost universal use of iron for naval equipments,—there is nothing calls more loudly for the interference of the legislature, than some enactment, to enforce the strict adherence to strength, and ductility, in the manufacture of every article of, as well as skill and solidity in the working, and welding of every description of anchors, chain-cables,—moving, standing, and running rigging, shackles, iron bolts, &c.; in short, of every kind of *fabrique* in wrought iron, now so generally introduced into marine equipments. For it must be borne in mind that sea-faring men, as well as the mercantile world, are totally ignorant of the real fundamental principles of sound workmanship in every thing relating to iron; and that they are merely led by the appearance of the material to the eye, and so long as it is smeared over with coal-tar, varnish, or other such preparation to make it shine, and give a good outside appearance, they are satisfied: hence arises the growing evil now becoming so seriously alarming, of so much mixed trash being made up in the different workshops, of the commonest iron, subjected to no test whatever, but being smeared over with the coating we have mentioned, attracts the eye, and is therefore sold to the shipping, and even invoiced to the merchants, in the colonies, for sale, at the same price as the firm, substantial, and severely tested chain-cable, made for the use of the shipping, of the best Blaenavon chain-cable iron, being the oldest, (upwards of fifty years,) and decidedly the best manufactory, in the kingdom, of material for marine purposes.

The great *desideratum* of having good ground tackle for every vessel going to sea, is of paramount importance; and many are the fatal instances of the loss, both of life and property, from failure and neglect, in this particular; and so seriously is the evil increasing, that it behoves the legislature to step forward, and frame some enactment, to counterbalance the wide-spreading mischief.

Every one must be aware, that it is one thing to find fault with, but another to devise rational means of putting a stop to any growing evil; and that it cannot be expected that the legislature can dive down at once into, and make laws, to keep up the solidity of any particular manufactured article, when there is so much fierce competition springing up in almost every branch of national industry. But when it is borne in mind that so many lives, and so much wealth are depending daily, and even hourly, on the safety of our ships and vessels, it certainly behoves the Government, as well as the Committee of Lloyds, to make searching enquiries into every matter that tends to the improvement of so desirable, so indispensable an object.

We will therefore proceed at once to offer a few suggestions, for the carrying of it into effect, in the most simple manner. Let every anchor-smith, and chain-cable manufacturer be permitted to take a drawing of the proving-machine at Woolwich; and on his setting up one of the kind on his own premises, let the permit or licence be granted by the Custom House Authorities at the port, or if, in the interior, by the Excise, and with a certain stamp or mark, such as might be agreed upon, and to be specified in the permit or licence, let such article be proved in the presence of an officer appointed for the purpose, according to the standard laid down at the royal yard at Woolwich; and having so conformed to these regulations, a permit should be granted, and the stamp affixed in confirmation of every anchor and cable having undergone such a test.

There are in most ports many naval officers, on half-pay, who would be available for such purposes, and who would undertake for a trifling consideration, on the granting of the permit or proof to the buyer or seller, as the case may be, to perform this easy duty.

Let the Committe of LLOYDS countenance such a regulation as the above, or any other that might be deemed more advisable, and the evil would soon be removed, it would work its own level, and find its own remedy, without any legislative enactment; and then the old, firm, and established Iron-Master would meet with the due reward of his labours; the lives and property of the merchant and sea-man would not be put into such frequent jeopardy, which must be the case, until some remedy be devised to prevent the unprincipled manufacturer from taking such advantages over the unwary and unguarded trader.

This system has, it is to be lamented, been carried to great excess, in almost every branch of national industry; and it is to be feared, that owing to credit having been formerly so easily obtained, it induced a great many to step out widely into fields of speculation, without capital, and many without knowledge and foresight in planing, and economy in carrying out their different projects.

The credit system is recommended by houses that obtain large profits, but the man, who studies his own happiness, will not long submit to it. Goods must be paid for, and an increase of comfort must arise from the absence of anxiety about bills becoming due, which many men, to their sorrow, too well understand; and it is to be hoped that we shall see the stern integrity of former times return again, when labour shall commence at the rising of the sun, and cease at the going down of the same, when men shall be content to eat the bread of carefulness, and by the generous hope of those advantages, which belong only to a patient well-doing will scorn to put in practice the tricks of the present day.

As excellence is never attained in man, but as the reward of labour, it argues indeed no small strength of mind, to persevere in the habits of industry, without the pleasure of perceiving those advantages, which, like the hands of a clock, whilst they make hourly approaches to their point, yet proceed so slowly as to escape observation.

For there is a certain steadiness, and sobriety of purpose, a certain trial in gradual progression, a certain endurance of circumstances, that are good for man. His body was not framed for indulgences, it grows weak, effeminate, and dwarfish, under such a system. It is good for us to bear the yoke, and especially in our youth. Too many children are injured by unnecessary attention, too much care, by too many servants at home, too many lessons at school, too many indulgences in society. They are not left sufficiently to exert their own powers, to make their own way. They are oftentimes indifferent and unhappy. They lack ingenuity and exertion, because they are taken out of the school of providence, and placed in one, which the foolish fondness and pride of parents have built for them.

Wealth without a law of entail to help it, has always lacked the energy to keep its own treasures; they drop from its own imbecile hand.

Hereditary wealth, is, in reality, a premium paid to idleness, an immense annuity expended to retain mankind in ignorance and selfishness. The poor are kept in ignorance from a want of leisure. The rich are furnished, indeed, with the means of cultivation, and promotion of literature, but they are paid for being dissipated and indolent. And it may here be remarked that the present desire to obtain landed possessions, is one of the traditionary prejudices derived from former times. And those circumstances, when the possession of such property was the only means of living, are now to a certain extent removed; but their influence is still felt, and still makes monied men purchase land, when that possession is by no means necessary to procure subsistence, nor even so advantageous as many other investments for capital.

A great number of our desires and passions, like this for land, are produced by circumstances which have passed away; and like it, however just, rational, and formerly unavoidable, may now be demonstrated as traditionary prejudices.

We believe, however, that this passion is now fast dying away amongst our money-making classes; and a great number of rich men have lately turned their attention to, and preferred mortgages and investments, in Iron, and Coal-works, to being troubled with leases, repairs, and bad tenants.

A man, trained in the school of industry and frugality, acquires large estates, which he leaves to his son, who in the same frame of mind, heaps up also great wealth, but he, dying, bequeaths it to his posterity; and, most frequently, it is lavished much faster than it was accumulated. It scarcely ever happens that three generations successively labour under the same temperament of mind and feelings.

Divine providence has placed every man in his peculiar situation, and assigned every man his work. The situations and occupations of mankind are various, but the appointment is of God. Some are appointed to guide the plough; others to direct the loom; some to toil, others to direct and think; some to study and teach; others to receive directions, and instructions; some are to submit,—others to govern.

Every man has his particular providential appointment given to him; and we may all discern it, if we wish to do so.

Whatever our situation is, God himself, in the councils of his wise providence, has placed us in it, and connected with it certain duties, which he enables us, by his infinite goodness, to fulfil.

Some persons imagine that the labours which arise from providential circumstances, are distinct from piety, and obstructive of it;—but this is an error; we may make them so, but they are not so necessarily. They are parts of duty, which, if performed with a view to the glory of God, from religious motives, and with regard to religious ends, (as they may be) will secure the divine blessing, and promote, rather than hinder, our eternal welfare.

Men, of the most ample fortunes, are the servants of God: and a thousand doors of usefulness stand open before those, who are exempt from the necessity of daily toil, and to whom God has been bountiful, in the gifts of his providence: and the man who hides his talent in the Earth, is deeply guilty, and incurs the displeasure of his Lord.

Idleness as infallibly destroys the soul, as open sin committed against God. We are all stewards of his manifold gifts, and God himself will, at length, say,—"*Give an account of thy stewardship, for thou mayest no longer be steward.*"

FINIS.

ELLIOTT, PRINTER, HEREFORD.